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IMPROVING PERFORMANCE IN THE MC-CDMA SYSTEMS BY MAXIMIZING THROUGHPUT TECHNIQUE

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ABSTRACT

Better channel allocation is one of the important problem in the latest generation mobile communication systems nowadays. Efficient data rate is most wanted for the usage of multimedia and Internet, So in this paper evaluates the performance of Adaptive Channel Allocation (ACA) algorithm and allocates the channels to users for high data rates in the downlink transmission of MC-CDMA systems. Simulations results shows that for downlink transmission a very high data rate, upto hundreds of Mbps can be obtained under the available power and given BER. By improving the ACA algorithm by changing the number of users and spreading factor. Performance of the system shows significant improvement in the throughput for the three combining schemes.

KEYWORDS: MC-CDMA, Throughput, BER, ACA

INTRODUCTION

In this paper spectrum allocation technique for MC-CDMA system is evaluated for the long time evolution and Rayleigh fading channel is used for the evaluation. The targets for downlink set to 1Gbit/s and uplink data rate requirements were set to 500Mbit/s. Previously throughput technique is maximized by improved algorithm [1]. Majorly channel fading is not same for different subcarriers so that feature has been developed for allocating the subcarriers to the users according to the instantaneous channel state information (CSI) in [1] and [2]. From the reference [2] ACA is proposed for maximizing throughput in which subchannels are divided into groups, these groups are allocated depending upon the user requirement. And in that paper channel fading feature is not fully developed. In [3] other subcarrier selection techniques are discussed by dividing the spectrum allocation techniques by two ways that is single channel allocation and group channel allocation. In [5] selected number of sub carriers is assigned to each user.

In this paper the concept is to assign each user only as many sub-carriers as are needed to support the user’s data rate. For addition of every filters for subcarrier selection the complexity of the system increases. Channel state information refers to amount of channel fading user experiences on particular channel. Some schemes have been proposed for sub carrier selection according to CSI which includes, selecting the sub carrier requiring least amount of transmit power on it.

In this paper how to require least amount of transmit power is evaluated for selecting a subcarrier is discussed. For improvement in BER performance, high data throughput in a multi-cell environment, reducing the consume high power at the mobile terminal, and results in high spectrum efficiency these results must shown by an appropriate sub-carrier selection technique. For the given power, throughput can be maximized by assigning maximum number of sub carriers to the users. The investigation method of sub channel allocation to the user for the given transmit power in the downlink transmission is done and from the CSI each user will require a different transmit power on each channel,

using this characteristic group of channels will be allotted to users. In the existing method of group allocation to the users has been modified which will result in producing with ACA algorithm[2].

FORMULATION OF MAXIMIZING THROUGHPUT

Proper use of channels and transmit power to maximize the throughput. In the downlink transmission of multiuser MCCDMA technique for the given transmit power at the base station maximum possible number of channels should be allocated to the users to maximize throughput maintaining low BER. If the required amount of transmit power of each channel has been determined for all users before the channel allocation, then throughput maximization problem is given by a following optimization c_g^u of problem as [2],

$$\max \sum_{u=1}^{U} \sum_{g=1}^{G} c_g^u$$

Where

c_g^u - Number of the uth user's channels on the gth group

U – Total number of users

G – Total number of groups of subcarriers.

$\sum_{u:}^{U}$

$$\sum_{u=1}^{U} \sum_{g=1}^{G} c_g^u$$

c_g^u *∈ { 0,1…………S}, For all u,g*

Where

S – Total number of subcarriers in gth group.

Above equation (1.b) is the total transmit power constraint.

Where

PT max – The maximum transmit power, and

P_g^u - The required transmit power for uth user on one channel of the gth group, it is expressed as,

$$p_g^u = \beta N_o S^{-2} \sum_{s=1}^{S} \left|\omega_{g,s}^u\right|^2 \sum_{s=1}^{S} \left|\omega_{g,s}^u f_{g,s}^u\right|^{-2}$$

β = Target threshold of BER.

f^u_{gs} – u th user's channel fading on the sth subcarrier of the desired group.

ω^u_{gs} - uth user's frequency domain combining weight for the signal on the sth subcarrier of the desired group.

Therefore the problem of throughput maximization can be put forward as, Every user experiences different fading on different channels and consequently user requires different transmit power on different channels. For the given system we have to form groups of neighbouring channels and then those groups are allocated to the users according to the transmit power requirement.

SUB CHANNEL SELECTION ALGORITHM

An improved algorithm is proposed in [7] for the channel allocation in the downlink transmission of multi-user MC- CDMA systems for throughput maximization, under the constraints that the total transmit power should not exceed the maximum transmit power and each channel's SINR should not be less than a pre-defined value. In this algorithm a sub channel group assignment technique is suggested as follows,

Criteria Used for Group Allocation

In this scheme, the group of sub channels are allocated to the different users by,

- Calculating required transmit power for the users on one channel of all groups.
- While allocating groups to the users, all the G number of groups will scan all the U number of users at the same time and the user requiring minimum transit power calculated as per improved algorithm allocated that group
- Next remaining(G-1) number of groups will scan all the remaining (U-1) number of users and so on

The algorithm follows

Initialization

$P_R = P^{max}{}_T$, C = {1,2,………,G}, C_G^u = 0 for

U = 1,….., U and g = 1,………, G.

Group assignment

While C

u = 1 : U

g = 1: G

[P_{min}, U_{gmin}] = min(min{$P_g{}^u$ }) % allocate a group to user requiring least power on one channel of that group

End

Channel allocation

While C

t = argmin { $P_g{}^{ugmin}$ }; % select the group with lowest power requirement.

$C_t{}^{utmin}$ = min % calculate the available channel number

$P_R = P_R - C_t{}^{utmin} p_t{}^{utmin}$; % calculate the residual transmit power

$C = C \setminus \{ u_{tmin} \}$;

If $C_t^{utmin} = 0$ % Since the residual transmit power is not enough, terminate channel allocation.

Break the loop;

End if

End While

Different combining schemes will result in different power allocation, accordingly required transmit power ($p^k{}_m$) will change. Frequency domain combining weights for MRC, EGC and ZFC schemes. Therefore throughput will be different for different combining schemes.

PERFORMANCE PARAMETERS

Total number of users 64

Number of channels 1024

Subcarrier spacing 25KHz

Target SINR -4 dB

Symbol rate 64Ksymbols/s

Here three comparisons are considered by compared with ACA algorithm, increasing number of users and by varying the spreading factor

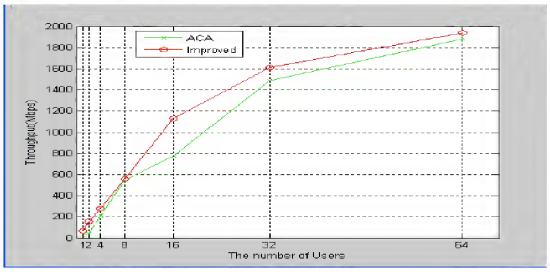

Figure 1: Throughput versus the Number of Users, When Max SNR is 20.12 dB

From the performance it can be seen very high data rate is achieved with combining schemes, for all 3 combining schemes outperform ACA algorithm in terms of throughput nearly equals to improved algorithm.

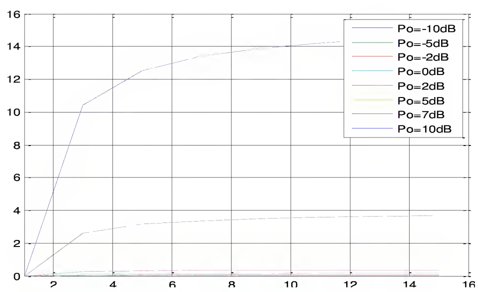

Figure 2: Throughput versus Maximum Transmit Power for All Combining Schemes, When the Spreading Factor and the Number of Users are 64

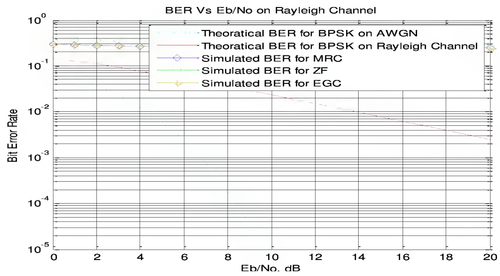

Figure 3: Reduced BER for All the Combining Schemes

It can be seen that as number of users increases group allocation to user scheme works in optimized manner as more number of users are available for scanning resulting in increase in throughput. In this paper summarized significantly improved performance in achieving a very high data rate required for latest 4G standard.

CONCLUSIONS

In this paper evaluated the performance of subcarrier allocation for the latest 3GPP standards. The channel model considered is Rayleigh fading channel model. In our algorithm helps to allocate more number of channels to more number of users under available transmit power at the base station.

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